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Nonradiological Environmental Report
Maamora Site, Morocco

Paris E. Althouse, lead author LLNL
Richard G. Blake, coauthor LLNL
Dr. Bryan B. Bandong, coauthor LLNL
Hatim Belghit, coauthor CNESTEN
Nabil Dehbi, coauthor CNESTEN

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Maamora Site, Morocco

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and National Nuclear Security Administration (NNSA)-
Lawrence Livermore National Laboratory
for
The Moroccan National Center for
Nuclear Energy Sciences and Techniques (CNESTEN)

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Paris E. Althouse, lead author LLNL
Richard G. Blake, co-author LLNL
Dr. Bryan B. Bandong, co-author LLNL
Hatim Belghit, coauthor CNESTEN
Nabil Dehbi, coauthor CNESTEN

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Abstract

Under the Sister Laboratory Arrangement between Lawrence Livermore National Laboratory (LLNL) and the Moroccan National Center for Nuclear Energy Sciences and Techniques (CNESTEN), environmental sampling and analysis were performed to assess the background concentrations of nonradiological constituents in various environmental media at the Maamora Forest CNESTEN Laboratory Site.

Samples were collected from surface soil, surface water and groundwater wells, short-lived vegetation (mainly native grass), and long-lived vegetation (cork oak). Samples were collected inside the property fence line, in the buffer zone surrounding the site, and off site at water locations. The soil and vegetation samples were analyzed for metals and pesticides and screened for polychlorinated biphenyls (PCBs); the water samples were analyzed for metals, general minerals, and pesticides and screened for PCBs.

Introduction

The Maamora site is located in northwestern area of Morocco between Rabat and Kenitra, approximately 8 kilometers inland from the Atlantic Ocean. The rural site is easily accessible and surrounded by cork oak in the Maamora Forest (see Map 1 for a map of the project area). At the time of sampling much of the physical construction of the buildings and laboratories was completed; however, no construction had begun in the area zoned for the research reactor.

This report details the sampling conducted July 2-5, 2002 that was designed to determine the background or baseline concentrations of National Pollution Discharge Emission Standard (NPDES) metals, general minerals, and semivolatile organic compounds, including pesticides detected in various media on and around the site. This data may be used to provide the baseline concentrations for the analytes measured.

Authors and Sampling Team

The sampling team included the following LLNL and CNESTEN staff members.

LLNL	CNESTEN
Richard Blake, Certified Geologist for Environmental Protection Department	Hatim Belghit, Sampling and Analysis Team Environmental Protection Department
Dr. Bryan Bandong, Program Leader for Chemistry and Environmental Services	Nabil Dehbi, Sampling and Analysis Team Environmental Protection Department
Paris Althouse, Environmental Analyst for Environmental Protection Department	

General Sampling Procedure

Location Selection

To determine sample locations, the site was divided into four quadrants. From each quadrant, three locations were selected using a stratified random approach. Samples are identified in tables as the quadrant (NW, NE, SW, SE), a number (01, 02, 03) and the sample type (SL-VG, LL-VG, SO, OW). Exceptions to this random selection process are identified below.

For soils and short-lived vegetation (e.g. grasses), the LLNL team selected sample locations that appeared to have the least amount of ground disturbance. As shown in Map 2, locations were selected within each quadrant and some were located in the buffer area around the site.

- One area was sampled because of its proximity to a waste area (paint shack) (Photo 5). It was expected that this area might have different results than the samples in undisturbed locations.
- Location NE03 was selected because it was the least disturbed area on-site and the actual location where the reactor will be built.
- Co-located samples were collected at location NW02 for analysis for quality control and quality assurance purposes.
- Water, soil and vegetation samples were collected at water pumping station (located nearby but off the CNESTEN site).
- For comparison purposes, additional soil, short-lived and long-lived vegetation composite samples were created. These were identified as Upwind Composite and Downwind Composite. The Upwind Composite samples were created from a sample aliquot from the upwind locations NW01, NW03, NE02, and SW03. The Downwind Composite samples were created from a sample aliquot from the downwind locations SW01, SE02, SE03, and NE01. Rational behind these composite samples was to determine a general site background level, not specifically the concentration at one location.

Soil Sampling Protocol

Sampling followed the procedures in References 1 and 2. In an attempt to find soils in a “natural” state, soil samples were collected in areas where there was little or no visible ground disturbance. Samples from these areas are believed to represent natural background levels and were not expected to have contaminants as the result of ground movement or construction activities.

Surface soil samples were collected from the top 5 cm of soil using a clean sampling coring device (Photo 1). A total mass of at least 200 grams was collected from each location. The soil surfaces were cleared of any vegetation prior to collection. All sampling personnel coming in contact with the soil wore clean sampling gloves that were replaced after each sample was collected.

Each surface soil core was placed in a plastic bag, and then doubled bagged. Each bag was labeled with the sampler's initials, date of collection, and the sample location using a permanent marker. All tools used in soil sampling were cleaned after each location using deionized water and then dried with disposable towels. Gloves were discarded after each location.

Short-lived Vegetation Sampling Protocol

For comparison purposes, short-lived vegetation was collected as near as possible to the soil sampling locations. Short-lived vegetation samples consisted primarily of miscellaneous dry native annual grasses composed primarily of the genus *Bromus* and *Poa*. These grasses would exhibit contamination from recent activities. Broad-leafed or noticeably different vegetation types were intentionally avoided (Photo 2). Grasses were cut using clean scissors and the scissors were cleaned after each sample was collected. The dried grasses were placed in lunch bag size paper sacks that were securely closed with tape. Three bags of native short-lived vegetation were collected at each location. Each sample was labeled with the location identifier, sampler's initials, date, and requested analysis.

Long-lived Vegetation Sampling Protocol

Cork oak (*Quercus suber*) was chosen for sampling because it is an important agricultural resource in this region. Results from cork oak bark represent long-term background activity.

One lunch bag sized (32 oz) paper bag of cork was collected from the outer bark of the tree closest to the soil sampling location. The specific tree location was documented in the field notebook. Samples were obtained by chipping off the top layer of cork using a knife or pick-hammer (Photo 3). Using this procedure, it was impossible to limit the depth of each cork segment, therefore more mass was collected than was analyzed.

Because the cork oak samples came off the trees at varying depths and dimensions, portions of the cork at each location were weighed and homogenized using a scale and a laboratory blender. The larger cork pieces were pulverized into finer non-uniform particles approximately 2–4 mm in diameter. This was done using a dedicated (newly purchased) industrial blender. The blender was thoroughly cleaned using de-ionized water after each composite.

Once pulverized, approximately 50 grams from each of the upwind and downwind locations was composited to create the composite samples for long-lived vegetation. Approximately 200 grams of pulverized cork for each composite was supplied to the laboratory for all the analysis.

Water Sampling Protocol and Locations

Water sampling included sampling of two groundwater wells and one surface water location (Map 1). The well closest to the Site was the "Pumping Station" well, located approximately 2 km to the west (ID number S-ENSO9ZO-0W on analytical Tables 7, 8, and 9). The second groundwater sampling was located approximately 6 km northwest of the Site, at well ENSO6Z5 (Map 1) and identified as S-ENSO6Z5 on Tables 7, 8, and 9. The pumping station well provides water to the CNESTEN site based on hydrogeological data provided by CNESTEN (Charafat Afailal, January 2002, Section 2.9. Hydrogeologie, excerpt from unknown French report), both wells are located generally down gradient from the site.

Hydrogeological data provided by CNESTEN suggests the regional water supply in this area is pumped from a confined aquifer. The confined aquifer is separated from the phreatic or upper unconfined aquifer by a clay-marl layer that extends north and westward over much of the Maamora Forest, and specifically in the area of the Site sample locations. Data suggests that this clay-marl layer terminates northwest of the ENSO6Z5 well and is not present near the Sebou River where the Discharge Point is located (Map 1). The regional aquifer is composed of Mio-Pliocene aged sands and gravels that crop out to the south and east where the aquifer is recharged, and thickens toward the north and west. Flow gradients from the Site are 0.5-0.8 cm / 100 cm flowing northward toward Kenitra and northwestward toward the Mehdiya area near well location ENSO6Z5.

At both groundwater sampling locations, samples were obtained after the wells pumped approximately 3 well volumes of water. Information such as pH and temperature were recorded for both wells and for the water at the discharge point and is shown in Table 1. No water depth information was provided at the Pumping Station well because the well was under pressure and surface facilities would not allow for a water depth measurement. At Well ENSO6Z5 a depth of 51.4 ft. was measured. At both wells, the screen depths / aquifer depths are not known but it is assumed that both wells were producing from the confined aquifer. Detailed information on well construction may be obtained from the Morocco Ministry of Environment.

Sampling protocol for water was done by triple rinsing polyethylene bottles and then filling, labeling, taping container lids, bagging in plastic zip-lock bags, and labeling the bags with the sample information. During all sampling and packaging, rubber gloves were worn. There were no preservation or special handling measures taken for water samples due to field limitations.

Surface water sampling at the Discharge Point (Map 1, Photo 4) included relatively moderate sampling methods using a polyethylene bucket and rope mechanism. This sample was taken to establish a baseline water analysis at the river at the "Future" CNESTEN Discharge Point. Approximately 500 ml of water was drafted from the river and poured into 100 ml polyethylene bottles. Standard labeling and handling protocols as mentioned above were followed.

Sample Shipment and Processing

Due to import controls placed on the importation of soil and vegetation into the United States, LLNL was required to obtain United States Department of Agriculture (USDA) permits before samples could be shipped from Morocco. LLNL was able to use an existing Soil Permit Number S-46701; however, a new application was required for the vegetation samples. There is no control for water samples; these water samples were sent to the US in early September 2002.

The vegetation permit (USDA Permit Number 63011) was granted on July 22, 2002. Computer and communication problems resulted in delay of the sample shipment from Morocco. The remaining soil samples were received by LLNL in early November. All sample inventories were complete and intact upon arrival.

Upon arrival from the Unites States Custom Department, all vegetation and soil samples were frozen by LLNL staff for at least 24 hours to eliminate any potential biological activity. Because of budgetary limitations, some samples were not analyzed and some were included in composites. One set of all three sample media, collected at the primary water pumping station, was also analyzed. All water samples were analyzed.

Analysis

Analytical processing of future samples will be performed at the CNESTEN Maamora site laboratory; however, at the time of this project, the CNESTEN laboratory was not yet operational. As a result, LLNL assumed responsibility for obtaining the analyses of the samples collected during this project. The CNESTEN Maamora site laboratory will perform future environmental analysis with duplicate analysis being performed by LLNL.

A certified laboratory in the United States performed all of the analyses. An electronic copy of all data is included on a CD along with this report. Printed copies of the data are available on request.

Analytical Methods

The soil and vegetation samples were analyzed for total threshold limit concentration values: Title 22 (TTLC) metals, pesticides (Environmental Protection Agency [EPA] 8081) and screened for PCBs. These samples were processed in accordance with Code of Federal Regulations, Title 40, “EPA Methods”, California Code of Regulations Title 22 “Standard Methods”.

The water samples were analyzed for a suite of general mineral constituents, National Pollution Discharge Emission Standard (NPDES) metals, and pesticides using EPA Method 525. The water samples were also screened for PCBs.

Data Interpretation

Soil

The primary concern for contamination in surface soil is the migration of these contaminants to the groundwater. A secondary concern for surface contamination is possibility that the contaminants can be taken up by plants, fed upon by vertebrates and invertebrates, and thus move into the ecosystem. The EPA is in the process of revising ecological soil screening levels (EcoSSLs) that take this into account. The "Draft Ecological Soil Screening Level (Eco-SSL) Guidance and Exhibits, and Related Federal Register Notice" can be found at the following web site:

http://www.epa.gov/superfund/programs/risk/ecorisk/ecossl.htm

Although these EcoSSLs are currently in draft, there is valuable information available for determining site-specific background concentrations. Attachment 1 is a portion of an earlier version of that document showing the generic soil screening levels (SSLs) using conservative assumptions**.** The SSL values are based on conservative dilution-attenuation factors (DAF). These factors are used to account for natural processes that reduce the contaminant concentration in the subsurface. DAF factors can be as low as 1 or as high as 100 depending on the depth to groundwater and the type of subsurface geology. LLNL did not have access to such subsurface data and therefore can only present possible DAF factors for CNESTEN Lab review. For guidance on determining the appropriate DAF factor for the Moroccan area, see Reference 3 or the web site listed above.

Unfortunately the holding times for the organochlorine pesticides (EPA 8081) and PCBs were exceeded, so nondetections in this data should not be definitively interpreted that no contamination is present. However, PCBs and organochlorines are very stable in the environment and the results of this data are a good indication that these semivolatile and volatile compounds are not present at levels of concern in the soil samples. Several samples detected DDE and DDT, which is not unexpected for agricultural areas where such pesticides are used for mosquito/malaria eradication. The pesticide detections are far below the EPA SSL of 3 and 2 mg/kg for DDE and DDT respectively using DAF=1. See Table 2 for the pesticides in soil data.

Metals in soil are also very stable and these data can be considered representative of the concentration of the metals at the time of sampling. Only chromium and mercury had their holding times exceeded, these two metals and the volatile organic compounds should be analyzed again when analyses can be perform within the required holding times.

Table 3 lists data for the metals detected in soil. Arsenic, chromium and nickel exceeded the DAF=1 but no metals were detected above the DAF=20. These levels are typical of environmental metals data.

Location NE3 had the only detection for mercury. While the concentration was very low (0.01 mg/kg) the origin of this is unknown; therefore, it warrants further investigation.

Vegetation

Two of the inorganic analytes, barium and potassium, were detected in every soil and every short-lived vegetation sample. Chart 1 presents the metals detected in soils and vegetation samples, Table 4 presents the pesticides detected in short- and long-lived vegetation and Table 5 presents the metals detected in the vegetation samples. Potassium is naturally present in soils world-wide so this result was expected and is consistent with environmental data from LLNL and elsewhere. Potassium is also an essential plant macronutrient (Reference 4) and thus will be found in large quantities in all plants. It is highly mobile and used by plants (and by animals as well) for osmoregulation. Some inorganic constituents will bio-concentrate in vegetation through intake from air, water or, soil. This was seen here, as concentrations were higher in vegetation than soil for some metals.

In addition to the co-located metals discussed above from Chart 1, arsenic, chromium, and vanadium were detected in all six of the soil samples (Table 6). Arsenic was detected in two of the vegetation samples; chromium and vanadium were not detected in any of the vegetation samples. None of these substances are essential plant nutrients, but could accumulate in plant tissue if found in the soil in high enough concentrations.

In contrast, there were fewer detections of copper, lead, and zinc in the soil samples than in the short-lived vegetation samples. One metal, mercury, was detected in one soil sample, but none of the vegetation samples. Copper and zinc are essential plant micronutrients. Uptake of these micronutrients by plants will occur at even low soil concentrations (i.e., below the detection limit). Copper is essential in cellular redox reactions. Copper deficiency is usually noted in the range of 3 to 5 mg/kg or below in leaf tissue. Copper can be toxic at higher concentrations, above 20 to 30 mg/kg. Zinc is important to enzyme function. Zinc deficiency in plants is common due to poor soil nutrition and interactions with phosphorus. Critical deficiency levels are below about 15 to 20 mg/kg zinc per dry wt of leaves. If zinc concentrations are very high in soil, zinc toxicity can result. Critical toxicity levels are above about 400 to 500 mg/kg dry wt. Copper and zinc concentrations found in the vegetation samples were on the lower end of normal range. Lead is not an essential nutrient, but depending on its form, can be very mobile and taken up readily by plants. Airborne lead can be taken up by plants through stomata.

No limits or standards for vegetation have been established by the Moroccan Ministry of the Environment. However, sampling and monitoring vegetation can provide information on the presence and movement of such contaminants.

Water

Analytical results for both groundwater sample locations and for the Discharge Point are shown on Tables 7, 8, and 9. Results on Tables 7 and 8 are for metals and general minerals and are both compared to the Morocco Ministry of Environment, “Terms de Reference”. The comparison is based on the Ministry of Environment Value Limits for Direct Discharge, and values (where provided) are shown on Tables 7 and 8. However, it must be pointed out that many of the constituents analyzed are not shown on the Ministry of Environment tables so there is no basis of comparison. Analytical results (Table 9) for semivolatile compounds (semivolatiles, organochlorine pesticides, nitrogen or phosphorous pesticides) are analyzed following U.S. EPA Method 525.2 and compared to primary USEPA drinking water standards.

The interpretation of these data are important to set a baseline chemical analysis for the Maamora Site. The interpretation of NPDES metals analyses (Table 7) indicates that no metals values exceeded the Ministry of Environment values for direct discharge water values. For general minerals (Table 8), some elevated values are shown at the Discharge Point. These elevated values should be expected due to high sediment influx and current runoff from metropolitan, industrial and commerce areas located upstream for the sample location. Table 9 presents a list of volatile organic compounds for which USEPA maximum contaminant values are available. The comparison of analytical results and MCL values indicates that no elevated levels were present based on MCL comparison. Other compounds were analyzed as part of the EPA Method 525.2 but were not included in Table 9 because USEPA MCL values were not available for comparison. For a complete list of all analyses, see the Excel spreadsheet titled “analysis.xls” included with this report.

The holding time for water analyses using EPA Method 525.2 was exceeded because of CNESTEN limitations on analytical laboratory capabilities as well as shipping and export problems. However, even though the water samples were analyzed beyond their holding times, many of the normal physical values such as pH, conductivity, TDS, and general minerals/metals data did show expected values throughout the data set and suggest that much of the data can be interpreted to be representative of site conditions. This was especially true in the Discharge Point data set.

Based on the interpreted confined aquifer conditions of the CNESTEN Site and also of Well ENSO6Z5, it is not surprising that there were no overall elevated values of contaminants in these wells. Based on the interpreted confined aquifer conditions at the sampling sites, it appears that if any surface contaminants were present at the site, they could not have affected the groundwater at the sample locations. However, it must be emphasized that additional hydraulic information regarding well screen depths, well pressure data, pumping history, well boring logs data, and regional hydrogeologic data should be used in conjunction with this report to accurately understand the hydraulic conditions at the groundwater sample locations

Recommendations

Because of limitations in shipping equipment from the United States to Morocco and analytical holding times, some important environmental sampling and analyses were not performed. This sampling includes air monitoring for metals and sampling for volatile organic constituents in water, vegetation, and soils. These analyses are important and are necessary to fully characterize the background levels at the site. LLNL recommends that CNESTEN staff perform this sampling and analysis before the start of the reactor and preferably before construction activity begins. Guidance and further training can be supplied by LLNL if requested.

We recommend quarterly sampling of all matrices (water, soil, and short-lived vegetation). Frequent monitoring of environmental media provides good baseline data for evaluation of future measurements, as well as providing an early indicator should a problem arise.

Though sediment sampling in the Mehdia / Oued Sebou River was not part of the scope of this project, it is recommended that sediments and more water samples be collected at this discharge point. Sediments show the accumulation of contaminants where surface waters may not. In addition, sampling water at different depths, time of day, and seasons will produce different contaminant levels. LLNL supports sampling and analyzing water to ensure effluent limits are met before discharging to the river.

We recommend re-sampling both groundwater well locations as well as the Discharge Point. This recommendation has two goals: provide a new set of samples to analyze within proper holding times, and secondly, provide time to collect additional information regarding site and regional hydraulic conditions that may lead to alternate groundwater sampling locations, different sampling techniques, or provide additional physical groundwater hydrology data that can be used to establish risk-based environmental practices for future land use at CNESTEN. Additional hydrogeological data may be useful to identify any unconfined aquifers or perched aquifers that may be used for future drinking water supplies. These aquifers would be more vulnerable to any future surface environmental discharge.

Acknowledgements

This work was accomplished through a team-effort between Lawrence Livermore National Laboratory and The Moroccan National Center for Nuclear Energy Sciences and Techniques (CNESTEN). The LLNL staff participating in Morocco included Rick Blake, Dr. Bryan Bandong, and Paris Althouse. Additional thanks to LLNL support from Don MacQueen, Dr. Tina Carlsen and Gretchen Gallegos. The CNESTEN participants include Ms Itimad Soufi, Smail Al-Hilali, Charafat Afailal, and sampling team members: Hatim Belghit and Nabil Dehbi (Photo 6).

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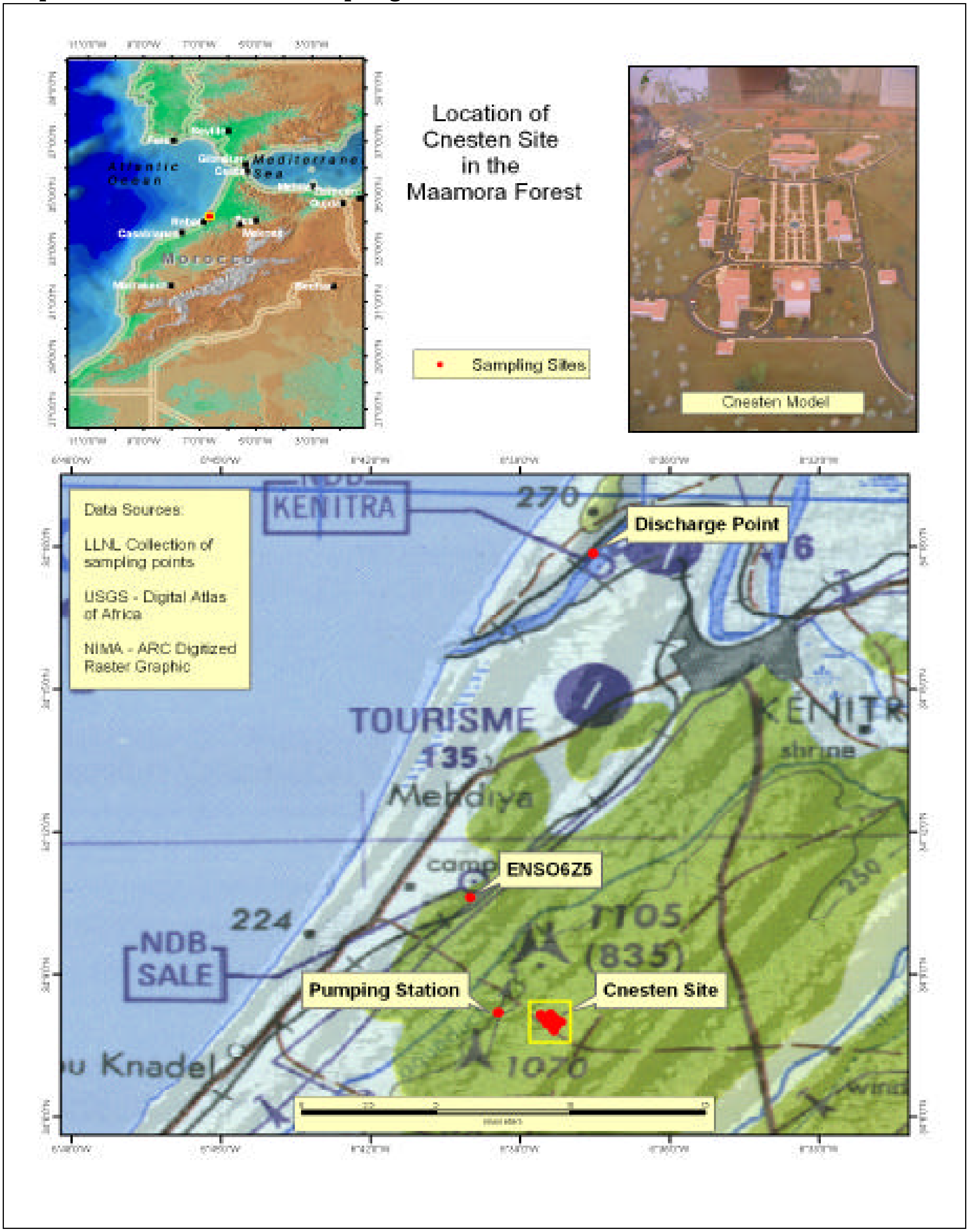
2. US DOE / EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, US DOE, Assistant Secretary for Environment, Washington D.C. 20585, 1991

3. EPA 540 / R95 / 128, Soil Screening Guidance: Technical Background Document, May 1996

4. Marschner, H. 1993. Mineral Nutrition of Higher Plants. Academic Press Inc. San Diego

Map 1. CNESTEN Site and sampling locations



Map 2. On site CNESTEN Sampling locations

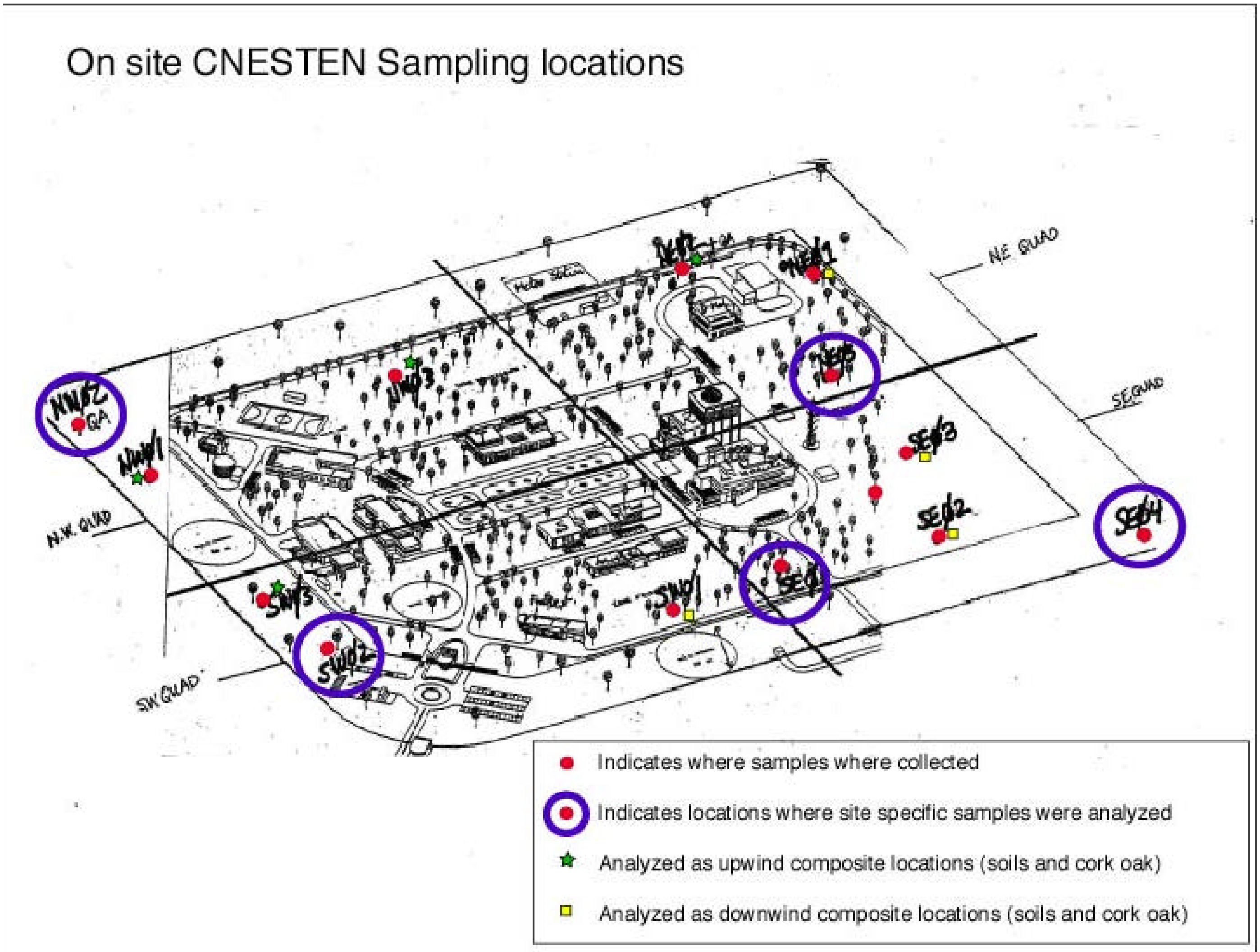


Photo 1. Soil sampling

Photo 2. Sample documentation and collection of short-lived vegetation

Photo 3. Long-lived vegetation (cork oak) collection

Photo 4. Water Discharge location

Photo 5. Location SE04, paint shack

Photo 6. Sampling Team with Ms. Soufi, Mr. Al Hilali and Charafat Afailal

Table 1. Sampling locations and field notebook data

Location Id	Date collected	# of containers	Medium collected	Requested Analysis	Latitude(DD)	Longitude (DD)	Altitude (HAE)	Comments
NW-01-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.135753	W6.64304	133.18	soils collected in buffer zone
NW-01-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NW-01-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork collected 6 meters north of GPS'ed point
NW-02-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.135865	W6.639777	143.531	Northern most corner of site, soils slightly disturbed but not from vehicle traffic.
NW-02-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NW-02-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				only cork in the vicinity, 2 meters NE of GPS point.
NW-03-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.134751	W6.638610	139.014	undisturbed soils
NW-03-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NW-03-VG	3-Jul-02	0	long-lived veg	no cork oak available				no cork oak trees
NW-QA-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.135865	W6.639777	143.531	Northern most corner of site, soils slightly disturbed but not from vehicle traffic.
NW-QA-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NW-QA-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				only cork in the vicinity, 2 meters NE of GPS point.
NE-01-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.133148	W6.636248	145.197	soil collected west of haz waste facity
NE-01-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NE-01-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				15 meters south of GPS position
NE-02-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.133907	W6.63750	129.243	undisturbed soils near met tower
NE-02-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NE-02-VG	3-Jul-02	0	long-lived veg	no cork oak available				no cork oak trees
NE-03-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.132404	W6.63787	142.295	undisturbed soils
NE-03-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
NE-03-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 10 meters south of GPS point
SW-01-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.132865	W6.60999	130.199	soils may have been distrurbed- movement 15 meters to the north and east
SW-01-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SW-01-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				5-7 meters west from GPS point
SW-02-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.134122	W6.641796	134.593	soil collected in buffer zone, no undistrubed soil avaiable inside perimeter
SW-02-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SW-02-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 6 meters to west of GPS point
SW-03-SO	3-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.134664	W6.641579	133.285	soil collected in buffer zone
SW-03-VG	3-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SW-03-VG	3-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 10 meters west of GPS
SE-01-SO	2-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.133262	W6.640234	138.621	soil collected in undisturbed cork oak grove
SE-01-VG	2-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SE-01-VG	2-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 10-15 meters NE of GPS position.
SE-02-SO	2-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.131500	W6.639160	141.305	undisturbed soils
SE-02-VG	2-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SE-02-VG	2-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 6 meters north of GPS position
SE-03-SO	2-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.131792	W6.638027	132.77	undisturbed soils near reactor site
SE-03-VG	2-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SE-03-VG	2-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				not the true closest cork oak, ANTS!, collected sample from tree 30-35 meters SW of GPS point
SE-QA-SO	2-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.131792	W6.638027	132.77	undisturbed soils near reactor site
SE-QA-VG	2-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SE-QA-VG	2-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				not the true closest cork oak, ANTS!, collected sample from tree 30-35 meters SW of GPS point
EXTRA SAMPLES								
SE-04-SO	4-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.130230	W6.638549	144.574	buffer zone undisturbed soil, however this loaction upgradiantfrom a staging area for oil drmus, paint cans, misc. haz waste.
SE-04-VG	4-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
SE-04-VG	4-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				cork oak 6 meters NE of GPS position
ENS09Z0-SO	4-Jul-02	1	soil	Pesticides/PCBs, Nutrients, Metals	N34.136559	W6.656990	110.755	soils collected just west of wellhead.
ENS09Z0-VG	4-Jul-02	3	short-lived veg	Pesticides/PCBs, Nutrients, Metals				dry annual grasses,
ENS09Z0-VG	4-Jul-02	1	long-lived veg	Pesticides/PCBs, Nutrients, Metals				corl oak 12 meters west of GPS position
ENS09Z0-WA	4-Jul-02	3	water	Nutrients, Metals, GENMIN pH= 7.22 water temp= 25.5° C	N34.136473	W6.657187	99.991	CNESTEN Site water source. Ground water untreated, pumps at 15-20L/sec. Well located Approx 1 mile offsite southside on main road.
QA- WA	4-Jul-02	3	water	Nutrients, Metals, GENMIN pH= 7.22 water temp= 25.5° C	N34.136473	W6.657187	99.991	CNESTEN Site water source. Ground water untreated, pumps at 15-20L/sec. Well located Approx 1 mile offsite southside on main road.
ENS06Z5-WA	4-Jul-02	3	water	Nutrients, Metals, GENMIN pH=6.97 water temp= 21.7° C depth to water 51.4 ft	N34.176959	W6.666622	75.82	Ground water well- open air, on SidiTaibi near tran station off main road. Pumped the well for about 30 seconds sampled from a port in piping
DischargePT-WA	4-Jul-02	3	water	Nutrients, Metals, GENMIN pH=7.76 water temp= 24.8° C	N34.297660	W6.625501	48.638	Discharge point approx 1 hour from the CNESTEN site

Table 2. Pesticides in soil

E8081	mg/kg	Aldrin		BHC, alpha isomer		BHC, beta isomer		BHC, delta isomer		BHC, gamma isomer (Lindane)	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
S-NE3-SO	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-NW2-SO DUP	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-NW2-SO RTN	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-PUMPSTN-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-SE1-SO	7/2/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-SE4-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-SW2-SO	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-DNWIND-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0
S-UPWIND-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.003	0	< 0.002	0

		Chlordane		Dieldrin		Endosulfan I		Endosulfan II		Endosulfan sulfate	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
S-NE3-SO	7/3/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-NW2-SO DUP	7/3/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-NW2-SO RTN	7/3/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-PUMPSTN-SO	7/4/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SE1-SO	7/2/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SE4-SO	7/4/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SW2-SO	7/3/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-DNWIND-SO	7/4/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-UPWIND-SO	7/4/02	< 0.005	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0

		Endrin		Endrin aldehyde		Heptachlor		Heptachlor epoxide		Methoxychlor	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
S-NE3-SO	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-NW2-SO DUP	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-NW2-SO RTN	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-PUMPSTN-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SE1-SO	7/2/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SE4-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-SW2-SO	7/3/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-DNWIND-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0
S-UPWIND-SO	7/4/02	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0	< 0.002	0

Table 2. Pesticides in soil (continued)

		p,p-DDD			p,p-DDE			p,p-DDT			Toxaphene		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-NE3-SO	7/3/02	<	0.002	0	<	0.002	0	<	0.002	0	<	0.02	0
S-NW2-SO DUP	7/3/02	<	0.002	0	<	0.002	0	<	0.002	0	<	0.02	0
S-NW2-SO RTN	7/3/02	<	0.002	0	<	0.002	0	<	0.002	0	<	0.02	0
S-PUMPSTN-SO	7/4/02	<	0.002	0		**0.002**	**0.004**	<	0.002	0	<	0.02	0
S-SE1-SO	7/2/02	<	0.002	0		**0.002**	**0.002**	<	0.002	0	<	0.02	0
S-SE4-SO	7/4/02	<	0.002	0	<	0.002	0	<	0.002	0	<	0.02	0
S-SW2-SO	7/3/02	<	0.002	0	<	0.002	0		**0.002**	**0.002**	<	0.02	0
S-DNWIND-SO	7/4/02	<	0.002	0		**0.002**	**0.004**		**0.002**	**0.007**	<	0.02	0
S-UPWIND-SO	7/4/02	<	0.002	0	<	0.002	0	<	0.002	0	<	0.02	0

All non detects except bolded data
LOS= Limit of sensitivity (minimum detection limit)
CALC= calculated positive detection

Table 3. Metals analysis for soils

TTLCMB+K	mg/kg	Antimony			Arsenic			Barium			Beryllium			Cadmium		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-NE3-SO	7/3/02	<	1	0		0.5	2.2		5	19	<	0.5	0	<	1	0
S-NW2-SO DUP	7/3/02	<	1	0		0.5	1.3		5	8	<	0.5	0	<	1	0
S-NW2-SO RTN	7/3/02	<	1	0		0.5	1.3		5	9	<	0.5	0	<	1	0
S-PUMPSTN-SO	7/4/02	<	1	0		0.5	0.8		5	11	<	0.5	0	<	1	0
S-SE1-SO	7/2/02	<	1	0		0.5	1.3		5	14	<	0.5	0	<	1	0
S-SE4-SO	7/4/02	<	1	0		0.5	1.1		5	15	<	0.5	0	<	1	0
S-SW2-SO	7/3/02	<	1	0		0.5	1.5		5	13	<	0.5	0	<	1	0
S-DNWIND-SO	7/4/02	<	1	0		0.5	1.3		5	10	<	0.5	0	<	1	0
S-UPWIND-SO	7/4/02	<	1	0		0.5	3.1		5	11	<	0.5	0	<	1	0
LLNL background screening limit		1.12			8.51			308			0.62			1.59		

	mg/kg	Chromium			Cobalt			Copper			Lead			Mercury		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-NE3-SO	7/3/02		5	10	<	5	0	<	5	0	<	10	0		**0.05**	**0.1**
S-NW2-SO DUP	7/3/02		5	10	<	5	0		**5**	**6**	<	10	0	<	0.05	0
S-NW2-SO RTN	7/3/02		5	10	<	5	0	<	5	0	<	10	0	<	0.05	0
S-PUMPSTN-SO	7/4/02		5	7	<	5	0	<	5	0	<	10	0	<	0.05	0
S-SE1-SO	7/2/02		5	9	<	5	0	<	5	0	<	10	0	<	0.05	0
S-SE4-SO	7/4/02		5	8	<	5	0	<	5	0	<	10	0	<	0.05	0
S-SW2-SO	7/3/02		5	10	<	5	0	<	5	0	<	10	0	<	0.05	0
S-DNWIND-SO	7/4/02		5	8	<	5	0	<	5	0	<	10	0	<	0.05	0
S-UPWIND-SO	7/4/02		5	9	<	5	0	<	5	0	<	10	0	<	0.05	0
LLNL background screening limit		72.4			14.6			62.5			43.7			0.14		

	mg/kg	Molybdenum			Nickel			Potassium			Selenium			Silver		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-NE3-SO	7/3/02	<	5	0	<	10	0		100	100	<	2.5	0	<	2.5	0
S-NW2-SO DUP	7/3/02	<	5	0		**10**	**20**		100	100	<	2.5	0	<	2.5	0
S-NW2-SO RTN	7/3/02	<	5	0	<	10	0		100	100	<	2.5	0	<	2.5	0
S-PUMPSTN-SO	7/4/02	<	5	0	<	10	0		100	100	<	2.5	0	<	2.5	0
S-SE1-SO	7/2/02	<	5	0	<	10	0		100	100	<	2.5	0	<	2.5	0
S-SE4-SO	7/4/02	<	5	0	<	10	0		100	100	<	2.5	0	<	2.5	0
S-SW2-SO	7/3/02	<	5	0	<	10	0		100	200	<	2.5	0	<	2.5	0
S-DNWIND-SO	7/4/02	<	5	0	<	10	0		100	200	<	2.5	0	<	2.5	0
S-UPWIND-SO	7/4/02	<	5	0	<	10	0		100	200	<	2.5	0	<	2.5	0
LLNL background screening limit		any detection			82.8			na			any detection			any detection		

Table 3. Metals analysis for soils (continued)

	mg/kg	Thallium		Vanadium		Zinc	
		LOS	CALC	LOS	CALC	LOS	CALC
S-NE3-SO	7/3/02	< 25	0	5	8	**5**	**45**
S-NW2-SO DUP	7/3/02	< 25	0	5	7	< 5	0
S-NW2-SO RTN	7/3/02	< 25	0	5	8	< 5	0
S-PUMPSTN-SO	7/4/02	< 25	0	5	5	< 5	0
S-SE1-SO	7/2/02	< 25	0	5	7	< 5	0
S-SE4-SO	7/4/02	< 25	0	5	6	< 5	0
S-SW2-SO	7/3/02	< 25	0	5	7	**5**	**7**
S-DNWIND-SO	7/4/02	< 25	0	5	6	**< 5**	**0**
S-UPWIND-SO	7/4/02	< 25	0	5	8	**5**	**7**
LLNL background screening limit		any detection		65.2		75.3	

All non detects except bolded data

LOS= Limit of sensitivity (minimum detection limit)

CALC= calculated positive detection

Table 4. Pesticides in vegetation

E8081	mg/kg	Aldrin			BHC, alpha isomer			BHC, beta isomer			BHC, delta isomer		
		dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DNWIND-VG	7/4/02	2	< 0.012	0	2	< 0.012	0	2	< 0.012	0	2	< 0.018	0
S-NE3-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-NW2-VG RTN	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-NW2-VG DUP	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-PUMPSTN-VG	7/4/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-SE1-VG	7/2/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-SE4-VG	7/4/02	1	< 0.012	0	1	< 0.012	0	1	< 0.012	0	1	< 0.018	0
S-SW2-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.036	0
S-UPWIND-VG	7/4/02	2	< 0.015	0	2	< 0.015	0	2	< 0.015	0	2	< 0.023	0

		BHC, gamma isomer (Lindane)			Chlordane			Dieldrin			Endosulfan I		
		dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DNWIND-VG	7/4/02	2	< 0.012	0	2	< 0.03	0	2	< 0.012	0	2	< 0.012	0
S-NE3-VG	7/3/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG RTN	7/3/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG DUP	7/3/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-PUMPSTN-VG	7/4/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-SE1-VG	7/2/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-SE4-VG	7/4/02	1	< 0.012	0	1	< 0.03	0	1	< 0.012	0	1	< 0.012	0
S-SW2-VG	7/3/02	2	< 0.024	0	2	< 0.06	0	2	< 0.024	0	2	< 0.024	0
S-UPWIND-VG	7/4/02	2	< 0.015	0	2	< 0.038	0	2	< 0.015	0	2	< 0.015	0

		Endosulfan II			Endosulfan sulfate			Endrin			Endrin aldehyde		
		dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DNWIND-VG	7/4/02	2	< 0.012	0	2	< 0.012	0	2	< 0.012	0	2	< 0.012	0
S-NE3-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG RTN	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG DUP	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-PUMPSTN-VG	7/4/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-SE1-VG	7/2/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-SE4-VG	7/4/02	1	< 0.012	0	1	< 0.012	0	1	< 0.012	0	1	< 0.012	0
S-SW2-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-UPWIND-VG	7/4/02	2	< 0.015	0	2	< 0.015	0	2	< 0.015	0	2	< 0.015	0

Table 4. Pesticides in vegetation (continued)

		Heptachlor			Heptachlor epoxide			Methoxychlor			p,p-DDD		
		dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DNWIND-VG	7/4/02	2	< 0.012	0	2	< 0.012	0	2	< 0.012	0	2	< 0.012	0
S-NE3-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG RTN	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-NW2-VG DUP	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-PUMPSTN-VG	7/4/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-SE1-VG	7/2/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-SE4-VG	7/4/02	1	< 0.012	0	1	< 0.012	0	1	< 0.012	0	1	< 0.012	0
S-SW2-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0	2	< 0.024	0
S-UPWIND-VG	7/4/02	2	< 0.015	0	2	< 0.015	0	2	< 0.015	0	2	< 0.015	0

		p,p-DDE			p,p-DDT			Toxaphene		
		dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DNWIND-VG	7/4/02	2	< 0.012	0	2	< 0.012	0	2	< 0.12	0
S-NE3-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-NW2-VG RTN	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-NW2-VG DUP	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-PUMPSTN-VG	7/4/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-SE1-VG	7/2/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-SE4-VG	7/4/02	1	< 0.012	0	1	< 0.012	0	1	< 0.12	0
S-SW2-VG	7/3/02	2	< 0.024	0	2	< 0.024	0	2	< 0.24	0
S-UPWIND-VG	7/4/02	2	< 0.015	0	2	< 0.015	0	2	< 0.15	0

All non detects

LOS= Limit of sensitivity (minimum detection limit)

CALC= calculated positive detection

Table 5. Metals in vegetation

TTLCMB+K	mg/kg	Antimony			Arsenic			Barium			Beryllium			Cadmium		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-DNWIND-VG	7/4/02	<	1	0		**0.5**	**1**		5	9	<	0.5	0	<	1	0
S-NE3-VG	7/3/02	<	1	0	**<**	**0.5**	**0**		5	25	<	0.5	0	<	1	0
S-NW2-VG RTN	7/3/02	<	1	0		**0.5**	**0.7**		5	36	<	0.5	0	<	1	0
S-NW2-VG DUP	7/3/02	<	1	0	<	0.5	0		5	34	<	0.5	0	<	1	0
S-PUMPSTN-VG	7/4/02	<	1	0	<	0.5	0		5	29	<	0.5	0	<	1	0
S-SE1-VG	7/2/02	<	1	0	<	0.5	0		5	34	<	0.5	0	<	1	0
S-SE4-VG	7/4/02	<	1	0	<	0.5	0		5	36	<	0.5	0	<	1	0
S-SW2-VG	7/3/02	<	1	0		**0.5**	**0.7**		5	24	<	0.5	0	<	1	0
S-UPWIND-VG	7/4/02	<	1	0		**0.5**	**0.8**		5	14	<	0.5	0	<	1	0

		Chromium			Cobalt			Copper			Lead (a)			Mercury		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-DNWIND-VG	7/4/02	<	5	0	<	5	0		**5**	**7**	<	10	0	<	0.1	0
S-NE3-VG	7/3/02	<	5	0	<	5	0	<	5	0	<	10	0	<	0.1	0
S-NW2-VG RTN	7/3/02	<	5	0	<	5	0		**5**	**5**		**20**	**1700**	<	0.1	0
S-NW2-VG DUP	7/3/02	<	5	0	<	5	0	<	5	0		**10**	**80**	<	0.1	0
S-PUMPSTN-VG	7/4/02	<	5	0	<	5	0	<	5	0	<	10	0	<	0.1	0
S-SE1-VG	7/2/02	<	5	0	<	5	0	<	5	0	<	10	0	<	0.1	0
S-SE4-VG	7/4/02	<	5	0	<	5	0	<	5	0	<	10	0	<	0.1	0
S-SW2-VG	7/3/02	<	5	0	<	5	0	<	5	0	<	10	0	<	0.1	0
S-UPWIND-VG	7/4/02	<	5	0	<	5	0		5	7	<	10	0	<	0.1	0

		Molybdenum			Nickel			Potassium (b)			Selenium			Silver		
			LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC		LOS	CALC
S-DNWIND-VG	7/4/02	<	5	0	<	10	0		**100**	**600**	<	2.5	0	<	2.5	0
S-NE3-VG	7/3/02	<	5	0	<	10	0		**200**	**4500**	<	2.5	0	<	2.5	0
S-NW2-VG RTN	7/3/02	<	5	0	<	10	0		**200**	**9000**	<	2.5	0	<	2.5	0
S-NW2-VG DUP	7/3/02	<	5	0	<	10	0		**200**	**8800**	<	2.5	0	<	2.5	0
S-PUMPSTN-VG	7/4/02	<	5	0	<	10	0		**200**	**5600**	<	2.5	0	<	2.5	0
S-SE1-VG	7/2/02	<	5	0	<	10	0		**200**	**5300**	<	2.5	0	<	2.5	0
S-SE4-VG	7/4/02	<	5	0	<	10	0		**200**	**7700**	<	2.5	0	<	2.5	0
S-SW2-VG	7/3/02	<	5	0	<	10	0		**200**	**8700**	<	2.5	0	<	2.5	0
S-UPWIND-VG	7/4/02	<	5	0	<	10	0		**100**	**700**	<	2.5	0	<	2.5	0

Table 5. Metals in vegetation (continued)

		Thallium			Vanadium			Zinc	
S-DNWIND-VG	7/4/02		LOS	CALC		LOS	CALC	LOS	CALC
S-NE3-VG	7/3/02	<	25	0	<	5	0	**5**	**8**
S-NW2-VG RTN	7/3/02	<	25	0	<	5	0	**5**	**65**
S-NW2-VG DUP	7/3/02	<	25	0	<	5	0	**5**	**33**
S-PUMPSTN-VG	7/4/02	<	25	0	<	5	0	**5**	**15**
S-SE1-VG	7/2/02	<	25	0	<	5	0	**5**	**17**
S-SE4-VG	7/4/02	<	25	0	<	5	0	**5**	**12**
S-SW2-VG	7/3/02	<	25	0	<	5	0	**5**	**17**
S-UPWIND-VG	7/4/02	<	25	0	<	5	0	**5**	**27**
		<	25	0	<	5	0	**5**	**9**

a dilution 2

b dilution 10

All non detections except bolded areas

LOS= limit of sensitivity (minimum detection limit)

CALC= calculated positive detection

Table 6. Number of metal detections in soils and vegetation

Analyte	Number of detections in soil	Number of detections in short-lived vegetation	Number of samples
Antimony	0	0	6
Arsenic	6	2	6
Barium	6	6	6
Beryllium	0	0	6
Cadmium	0	0	6
Chromium	6	0	6
Cobalt	0	0	6
Copper	0	1	6
Lead	0	2	6
Mercury	1	0	6
Molybdenum	0	0	6
Nickel	0	0	6
Potassium	6	6	6
Selenium	0	0	6
Silver	0	0	6
Thallium	0	0	6
Vanadium	6	0	6
Zinc	2	6	6

Table 7. NPDES metals analysis in water

NPDESMETAL			Aluminum		Antimony			Arsenic			Barium		Beryllium		
			LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	mg/L	0.1	0.7							0.025	0.081			
S-DISCHGE-OW	7/4/02	µg/L			5	<5	0	5	5	44			5	<0.5	0
S-ENSO6Z5-OW	7/4/02	mg/L	<0.1	0							0.025	0.033			
S-ENSO6Z5-OW	7/4/02	µg/L			1	<5	0	1	<2	0			1	<0.2	0
S-ENSO9Z0-OW **DUP**	7/4/02	mg/L	<0.05	0	1	<0.005	0	1	<0.002	0	0.025	0.03	1	<0.0002	0
S-ENSO9Z0-OW **RTN**	7/4/02	mg/L	<0.1	0							0.025	0.026			
S-ENSO9Z0-OW **RTN**	7/4/02	µg/L			1	<5	0	1	<2	0			1	<0.2	0
Maximum discharge values* mg/L			NA		NA			0.1			1.0		NA		

NPDESMETAL			Boron		Cadmium			Chromium			Cobolt	
			LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	LOS	CALC
S-DISCHGE-OW	7/4/02	mg/L	0.1	3.6							<0.05	0
S-DISCHGE-OW	7/4/02	µg/L			5	<0.5	0	5	<2.5	0		
S-ENSO6Z5-OW	7/4/02	mg/L	<0.1	0							<0.05	0
S-ENSO6Z5-OW	7/4/02	µg/L			1	<0.5	0	1	<1	0		
S-ENSO9Z0-OW **DUP**	7/4/02	mg/L	0.05	0.073	1	0.0005	0	1	<0.001	0	<0.05	0
S-ENSO9Z0-OW RTN	7/4/02	mg/L	<0.1	0							<0.05	0
S-ENSO9Z0-OW **RTN**	7/4/02	µg/L			1	<0.5	0	1	<1	0		
Maximum discharge values* mg/L			NA		0.2			2.0			0.5	

NPDESMETAL			Copper			Hexavalent Chromium		Iron		Lead		
			dilution	LOS	CALC	LOS	CALC	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	mg/L						0.1	0.4			
S-DISCHGE-OW	7/4/02	µg/L	5	5	9					5	<5	0
S-ENSO6Z5-OW	7/4/02	mg/L						<0.1	0			
S-ENSO6Z5-OW	7/4/02	µg/L	1	<1	0					1	<5	0
S-ENSO9Z0-OW **DUP**	7/4/02	mg/L	1	0.001	0.0024	<0.002	0	<0.1	0	1	<0.005	0
S-ENSO9Z0-OW RTN	7/4/02	mg/L						<0.1	0			
S-ENSO9Z0-OW **RTN**	7/4/02	µg/L	1	1	3					1	<5	0
Maximum discharge values* mg/L			NA			2.0		3.0		0.5		

NPDESMETAL			Manganese		Mercury		Molybdenum		Nickel			Selenium		
			LOS	CALC	LOS	CALC	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	mg/L	<0.03	0			<0.025	0						
S-DISCHGE-OW	7/4/02	µg/L			<0.2	0			5	5	15	5	5	21
S-ENSO6Z5-OW	7/4/02	mg/L	<0.03	0			<0.025	0						
S-ENSO6Z5-OW	7/4/02	µg/L			<0.2	0			1	<5	0	1	<5	0
S-ENSO9Z0-OW **DUP**	7/4/02	mg/L	<0.03	0	<0.0002	0	<0.025	0	1	0.002	0.0038	1	<0.002	0
S-ENSO9Z0-OW RTN	7/4/02	mg/L	<0.03	0			<0.025	0						
S-ENSO9Z0-OW **RTN**	7/4/02	µg/L			<0.2	0			1	<5	0	1	<5	0
Maximum discharge values* mg/L			1.0		.05		NA		0.5			0.1		

Table 7. NPDES metals analysis in water (continued)

NPDESMETAL			Silver			Thallium			Vanadium		Zinc	
			dilution	LOS	CALC	dilution	LOS	CALC	LOS	CALC	LOS	CALC
S-DISCHGE-OW	7/4/02	mg/L							<0.02	0	<0.02	0
S-DISCHGE-OW	7/4/02	µg/L	5	<1	0	5	<5	0				
S-ENSO6Z5-OW	7/4/02	mg/L							<0.02	0	<0.02	0
S-ENSO6Z5-OW	7/4/02	µg/L	1	<1	0	1	<1	0				
S-ENSO9Z0-OW **DUP**	7/4/02	mg/L	1	<0.001	0	1	<0.001	0	<0.02	0	<0.02	0.32
S-ENSO9Z0-OW RTN	7/4/02	mg/L							<0.02	0	<0.02	0.77
S-ENSO9Z0-OW **RTN**	7/4/02	µg/L	1	<1	0	1	<1	0				
Maximum discharge values* mg/L			0.1			NA			NA		5.0	

Note:

* Maximum value for direct discharge (Morocco Ministry of Environment).
http://www.minenv.gov.ma/projets/fodep/TDRFOD2.htm

Table 8. General minerals analysis in water

GENMIN (General Minerals)	mg/L	Aluminum		Bicarbonate Alk (as $CaCO_3$)			Calcium			Carbonate Alk (as $CaCO_3$)			Chloride		
		LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	<0.2	0.7	1	1	150	4	2	280	1	<1	0	100	50	13000
S-ENSO6Z5-OW	7/4/02	<0.2	0	1	1	350	2	1	130	1	<1	0	10	5	66
S-ENSO9Z0-OW **DUP**	7/4/02	<0.05	0	2	5	280	1	0.5	86	2	<5	0	1	0.5	43
S-ENSO9Z0-OW **RTN**	7/4/02	<0.2	0	1	1	270	1	0.5	94	1	<1	0	10	5	55
Maximum discharge values* mg/L		10.0		NA			NA			NA			NA		

GENMIN	mg/L	Copper		Fluoride		Hydroxide Alk (as ($CaCO_3$)			Iron		Magnesium		
		LOS	CALC	LOS	CALC	dilution	LOS	CALC	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	<0.05	0	0.05	0.11	1	1	0			10	5	880
S-ENSO6Z5-OW	7/4/02	<0.05	0	0.05	0.27	1	1	0			1	0.5	8.4
S-ENSO9Z0-OW **DUP**	7/4/02	<0.01	0	0.05	0.083	2	5	0	<0.05	0	1	0.5	8.1
S-ENSO9Z0-OW RTN	7/4/02	<0.05	0	0.05	0.28	1	1	0			1	0.5	8.2
Maximum discharge values* mg/L		0.5		NA		NA			3.0		NA		

GENMIN	mg/L	Manganese		Nickel		Nitrate (as N)		Nitrate (as NO_3)		Nitrate plus Nitrate (as N)		Nitrate (as N)	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
S-DISCHGE-OW	7/4/02			<0.1	0	0.1	1	0.1	4.4			<0.1	0
S-ENSO6Z5-OW	7/4/02			<0.1	0	0.1	7.7	0.1	34			<0.1	0
S-ENSO9Z0-OW **DUP**	7/4/02	<0.01	0	<0.05	0	0.1	1.5	0.4	6.6	0.1	1.5	<0.02	0
S-ENSO9Z0-OW RTN	7/4/02			<0.1	0	0.1	4	0.1	18			<0.1	0
Maximum discharge values* mg/L		1.0		0.5		NA		NA		NA		NA	

GENMIN	mg/L	Ortho Phosphate		pH (Units)		Potassium			Sodium		
		LOS	CALC	LOS	CALC	dilution	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	0.02	0.61	0.1	7.8	10	10	450	100	100	6600
S-ENSO6Z5-OW	7/4/02	<0.02	0	0.1	8	1	1	2	1	1	41
S-ENSO9Z0-OW **DUP**	7/4/02	<0.05	0	0	7.42	1	1	1.1	1	1	38
S-ENSO9Z0-OW RTN	7/4/02	<0.02	0	0.1	8.1	1	1	2	1	1	41
		NA		6.5–8.5		NA			NA		

GENMIN	mg/L	Specific Conductance (μmhos/cm)			Sulfate			Surfactants		Total Alkalinity (as $CaCO_3$)		
		dilution	LOS	CALC	dilution	LOS	CALC	LOS	CALC	dilution	LOS	CALC
S-DISCHGE-OW	7/4/02	10	100	40000	100	100	1800	<0.5	0	1	1	150
S-ENSO6Z5-OW	7/4/02	10	100	1000	1	1	7	<0.5	0	1	1	350
S-ENSO9Z0-OW **DUP**	7/4/02	1	1	671	1	1	6.1	<0.5	0	2	5	280
S-ENSO9Z0-OW **RTN**	7/4/02	1	10	680	1	1	8	<0.5	0	1	1	270
Maximum discharge values* mg/L		2700*			NA			NA		NA		

Table 8. General minerals analysis in water (continued)

GENMIN	mg/L	Total dissolved solids (TDS)			Total Hardness (as $CaCO_3$)		Total Kjeldahl Nitrogen		Total Phosphorus (as P)		Total Phosphorus (as PO_4)		Zinc	
		dilution	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
S-DISCHGE-OW	7/4/02	2	2	23000	1	4300	<0.2	0.4			0.05	0.11	<0.05	0
S-ENSO6Z5-OW	7/4/02	1	1	510	1	360	<0.2	0			<0.05	0	<0.05	0
S-ENSO9Z0-OW **DUP**	7/4/02	2	20	306	5	248	<0.2	0	<0.05	0			0.05	0.36
S-ENSO9Z0-OW **RTN**	7/4/02	1	1	380	1	270	<0.2	0			0.05	0.28	0.05	0.77
Maximum discharge values* mg/L		NA			NA		30.0		10.0		NA		5.0	

Note:

* Maximum value for direct discharge (Morocco Ministry of Environment). http://www.minenv.gov.ma/projets/fodep/TDRFOD2.htm

Table 9. Semivolatile organic compounds

EPA Method 525.2 E525 (All dilutions = 1)		Benzo(a)pyrene		Endrin		Heptachlor		Heptachlor epoxide		Hexachloro-benzene		Hexachloro-cyclopentadiene	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
ENS06Z5-OW	7/4/02	<0.5	0	<2	0	<0.5	0	<0.5	0	<1	0	<3	0
ENS09Z0-OW	7/4/02	<0.5	0	<2	0	<0.5	0	<0.5	0	<1	0	<3	0
DISCHARGE-OW	7/4/02	<0.5	0	<2	0	<0.5	0	<0.5	0	<1	0	<3	0
QA-WATER-OW	7/4/02	<0.1	0										
***US-EPA MCL**		0.2		2		0.4		0.2		1		50	

EPA Method 525.2 E525 (All dilutions = 1)		Pentachlorophenol		Alachlor		Atrazine		Chlordane		Di (2-ethylhexyl) adipate		Methoxychlor	
		LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC	LOS	CALC
ENS06Z5-OW	7/4/02	<1	0	<0.5	0	<0.5	0	<2	0	<1	0	<0.7	0
ENS09Z0-OW	7/4/02	<1	0	<0.5	0	<0.5	0	<2	0	<1	0	<0.7	0
DISCHARGE-OW	7/4/02	<1	0	<0.5	0	<0.5	0	<2	0	<1	0	<0.7	0
QA-WATER-OW	7/4/02			1	0	<1	0						
***US-EPA MCL**		1		2		3		2		400		40	

EPA Method 525.2 E525 (All dilutions = 1)		PCB		Simazine		Toxaphene	
		LOS	CALC	LOS	CALC	LOS	CALC
ENS06Z5-OW	7/4/02	0.5	0	0.5	0	5	0
ENS09Z0-OW	7/4/02	0.5	0	0.5	0	5	0
DISCHARGE-OW	7/4/02	0.5	0	0.5	0	5	0
QA-WATER-OW	7/4/02			1	0		
***US-EPA MCL**		0.5		4		3	

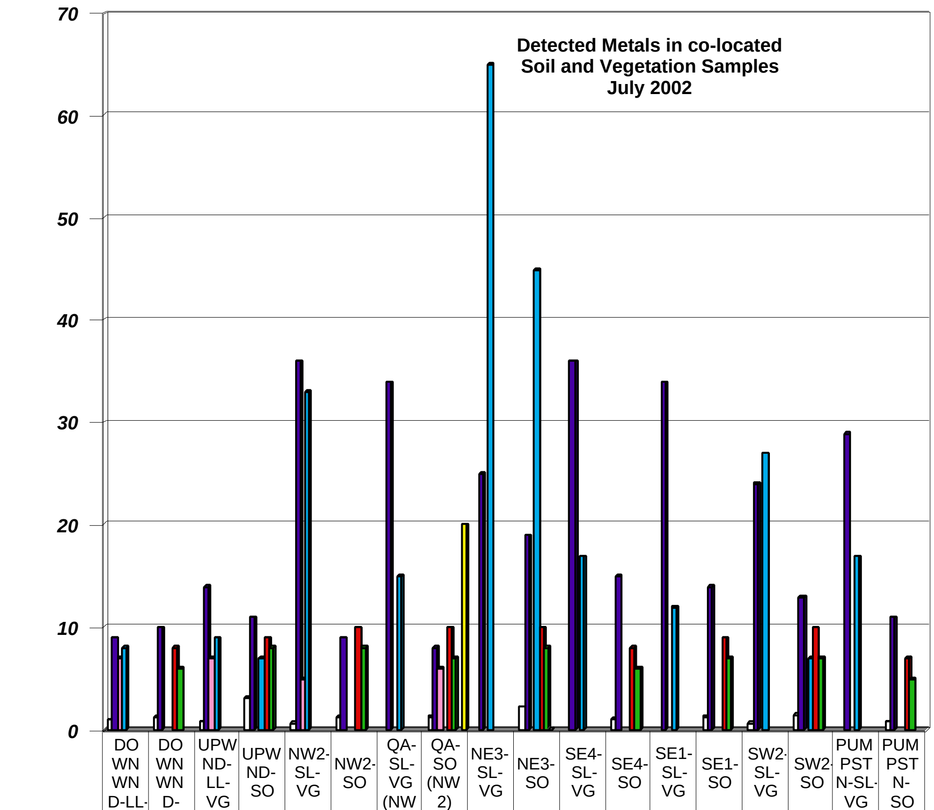
Notes:

All 525.2 water analyses performed by BC Laboratories Inc., except sample “QA-WATER-OW” which was analyzed by Caltest Laboratories.

All values presented are in µg/L.

* US EPA Maximum Contaminant Level (MCL) for National Primary Drinking Water Regulations.

Go to: http://www.epa.gov. In the “Search” window, type “MCL.” Click on “Go.” Under “Title and Summary” click on #2, List of Drinking Water Contaminants and MCLs.



	DOWNWND-LL-	DOWNWND-	UPWND-LL-VG	UPWND-SO	NW2-SL-VG	NW2-SO	QA-SL-VG (NW	QA-SO (NW2)	NE3-SL-VG	NE3-SO	SE4-SL-VG	SE4-SO	SE1-SL-VG	SE1-SO	SW2-SL-VG	SW2-SO	PUMPSTN-SL-VG	PUMPSTN-SO
Arsenic	1	1.3	0.8	3.1	0.7	1.3		1.3		2.2		1.1		1.3	0.7	1.5		0.8
Barium	9	10	14	11	36	9	34	8	25	19	36	15	34	14	24	13	29	11
Copper	7		7		5			6										
Zinc	8		9	7	33		15		65	45	17		12		27	7	17	
Chromium		8		9		10		10		10		8		9		10		7
Vanadium		6		8		8		7		8		6		7		7		5
Mercury										0.1								
Nickel								20										

Chart 1. Metals in short-lived and long-lived vegetation and soils co-located samples

Attachment 1:

Appendix A of EPA 540/R95/128, Soil Screening Guidance: Technical Background Document, May 1996

FROM EPA/540/R95/128
MAY 1996
SOIL SCREENING GUIDANCE: TECHNICAL BACKGROUND DOCUMENT

APPENDIX A

Generic SSLs

Table A-1 provides generic SSLs for 110 chemicals. Generic SSLs are derived using default values in the standardized equations presented in Part 2 of this document. The default values (listed in Table A-2) are conservative and are likely to be protective for the majority of site conditions across the nation.

However, the generic SSLs are not necessarily protective of all known human exposure pathways, reasonable land uses, or ecological threats. Thus, before applying generic SSLs at a site, it is extremely important to compare the conceptual site model (see the *User's Guide)* with the assumptions behind the SSLs to ensure that the site conditions and exposure pathways match those used to develop generic SSLs (see Parts 1 and 2 and Table A-2). If this comparison indicates that the site is more complex than the SSL scenario, or that there are significant exposure pathways **not** accounted for by the SSLs, then generic SSLs are not sufficient for a full evaluation of the site. A more detailed site-specific approach will be necessary to evaluate the additional pathways or site conditions.

Generic SSLs are presented separately for major pathways of concern in both surface and subsurface soils. The first column to the right of the chemical name presents levels based on direct ingestion of soil and the second column presents levels based on inhalation. As discussed in the *User's Guide*, the fugitive dust pathway may be of concern for certain metals but does not appear to be of concern for organic compounds. Therefore, SSLs for the fugitive dust pathway are only presented for inorganic compounds. Except for mercury, no SSLs for the inhalation of volatiles pathway are provided for inorganic compounds because these chemicals are not volatile.

The user should note that several of the generic SSLs for the inhalation of volatiles pathway are determined by the soil saturation concentration (C_{sat}), which is used to address and screen the potential presence of nonaqueous phase liquids (NAPLs). As explained in Section 2.4.4, for compounds that are liquid at ambient soil temperature, concentrations above C_{sat} indicate a potential for free-phase liquid contamination to be present and the need for additional investigation.

The third column presents generic SSL values for the migration to ground water pathway developed using a default DAF (dilution-attenuation factor) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface (see Section 2.5.6). SSLs in Table A-1 are rounded to two significant figures except for values less than 10, which are rounded to one significant figure. Note that the 20 DAF values in Table A-1 are not exactly 20 times the 1 DAF values because each SSL is calculated independently in both the 20 DAF and 1 DAF columns, with the final value presented according to the aforementioned rounding conventions.

The fourth column contains the generic SSLs for the migration to ground water pathway developed assuming no dilution or attenuation between the source and the receptor well (i.e., a DAF of 1). These values can be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected at a site (e.g., sites with shallow water tables, fractured media, karst topography, or source size greater than 30 acres).

Generally, if an SSL is not exceeded for a pathway of concern, the user may eliminate the pathway or areas of the site from further investigation. If more than one exposure pathway is of concern, the lowest SSL should be used.

Table A-1. Generic SSLs [a]

Organics				Migration to ground water	
CAS No.	Compound	Ingestion (mg/kg)	Inhalation volatiles (mg/kg)	20 DAF (mg/kg)	1 DAF (mg/kg)
83-32-9	Acenaphthene	4,700 [b]	--- [c]	570 [b]	29 [b]
67-64-1	Acetone	7,800 [b]	1.0E+05 [d]	16 [b]	0.8 [b]
309-00-2	Aldrin	0.04 [e]	3 [e]	0.5 [e]	0.02 [e]
120-12-7	Anthracene	23,000 [b]	--- [c]	12,000 [b]	590 [b]
56-55-3	Benz(*a*)anthracene	0.9 [e]	--- [c]	2 [e]	0.08 [e,f]
71-43-2	Benzene	22 [e]	0.8 [e]	0.03	0.002 [f]
205-99-2	Benzo(*b*)fluoranthene	0.9 [e]	--- [c]	5 [e]	0.2 [e,f]
207-08-9	Benzo(*k*)fluoranthene	9 [e]	--- [c]	49 [e]	2 [e]
65-85-0	Benzoic acid	3.1E+05 [b]	--- [c]	400 [b,i]	20 [b,i]
50-32-8	Benzo(*a*)pyrene	0.09 [e,f]	--- [c]	8	0.4
111-44-4	Bis(2-chloroethyl)ether	0.6 [e]	0.2 [e,f]	0.0004 [e,f]	2E-05 [e,f]
117-81-7	Bis(2-ethylhexyl)phthalate	46 [e]	31,000 [d]	3,600	180
75-27-4	Bromodichloromethane	10 [e]	3,000 [d]	0.6	0.03
75-25-2	Bromoform	81 [e]	53 [e]	0.8	0.04
71-36-3	Butanol	7,800 [b]	10,000 [d]	17 [b]	0.9 [b]
85-68-7	Butyl benzyl phthalate	16,000 [b]	930 [d]	930 [d]	810 [b]
86-74-8	Carbazole	32 [e]	--- [c]	0.6 [e]	0.03 [e,f]
75-15-0	Carbon disulfide	7,800 [b]	720 [d]	32 [b]	2 [b]
56-23-5	Carbon tetrachloride	5 [e]	0.3 [e]	0.07	0.003 [f]
57-74-9	Chlordane	0.5 [e]	20 [e]	10	0.5
106-47-8	*p*-Chloroaniline	310 [b]	--- [c]	0.7 [b]	0.03 [b,f]
108-90-7	Chlorobenzene	1,600 [b]	130 [b]	1	0.07
124-48-1	Chlorodibromomethane	8 [e]	1,300 [d]	0.4	0.02
67-66-3	Chloroform	100 [e]	0.3 [e]	0.6	0.03
95-57-8	2-Chlorophenol	390 [b]	53,000 [d]	4 [b,i]	0.2 [b,f,i]
218-01-9	Chrysene	88 [e]	--- [c]	160 [e]	8 [e]
72-54-8	DDD	3 [e]	--- [c]	16 [e]	0.8 [e]
72-55-9	DDE	2 [e]	--- [c]	54 [e]	3 [e]
50-29-3	DDT	2 [e]	--- [g]	32 [e]	2 [e]
53-70-3	Dibenz(*a,h*)anthracene	0.09 [e,f]	--- [c]	2 [e]	0.08 [e,f]
84-74-2	Di-*n*-butyl phthalate	7,800 [b]	2,300 [d]	2,300 [d]	270 [b]
95-50-1	1,2-Dichlorobenzene	7,000 [b]	560 [d]	17	0.9
106-46-7	1,4-Dichlorobenzene	27 [e]	--- [g]	2	0.1 [f]
91-94-1	3,3-Dichlorobenzidine	1 [e]	--- [c]	0.007 [e,f]	0.0003 [e,f]
75-34-3	1,1-Dichloroethane	7,800 [b]	1,300 [b]	23 [b]	1 [b]
107-06-2	1,2-Dichloroethane	7 [e]	0.4 [e]	0.02	0.001 [f]
75-35-4	1,1-Dichloroethylene	1 [e]	0.07 [e]	0.06	0.003 [f]
156-59-2	*cis*-1,2-Dichloroethylene	780 [b]	1,200 [d]	0.4	0.02
156-60-5	*trans*-1,2-Dichloroethylene	1,600 [b]	3,100 [d]	0.7	0.03
120-83-2	2,4-Dichlorophenol	230 [b]	--- [c]	1 [b,i]	0.05 [b,f,i]

Table A-1 (continued)

CAS No.	Compound	Ingestion (mg/kg)	Inhalation volatiles (mg/kg)	Migration to ground water: 20 DAF (mg/kg)	Migration to ground water: 1 DAF (mg/kg)
Organics					
78-87-5	1,2-Dichloropropane	9 [e]	15 [b]	0.03	0.001 [f]
542-75-6	1,3-Dichloropropene	4 [e]	0.1 [e]	0.004 [e]	0.0002 [e]
60-57-1	Dieldrin	0.04 [e]	1 [e]	0.004 [e]	0.0002 [e,f]
84-66-2	Diethylphthalate	63,000 [b]	2,000 [d]	470 [b]	23 [b]
105-67-9	2,4-Dimethylphenol	1,600 [b]	--- [c]	9 [b]	0.4 [b]
51-28-5	2,4-Dinitrophenol	160 [b]	--- [c]	0.3 [b,f,i]	0.01 [b,f,i]
121-14-2	2,4-Dinitrotoluene	0.9 [e]	--- [c]	0.0008 [e,f]	4E-05 [e,f]
606-20-2	2,6-Dinitrotoluene	0.9 [e]	--- [c]	0.0007 [e,f]	3E-05 [e,f]
117-84-0	Di-*n*-octyl phthalate	1,600 [b]	10,000 [d]	10,000 [d]	10,000 [d]
115-29-7	Endosulfan	470 [b]	--- [c]	18 [b]	0.9 [b]
72-20-8	Endrin	23 [b]	--- [c]	1	0.05
100-41-4	Ethylbenzene	7,800 [b]	400 [d]	13	0.7
206-44-0	Fluoranthene	3,100 [b]	--- [c]	4,300 [b]	210 [b]
86-73-7	Fluorene	3,100 [b]	--- [c]	560 [b]	28 [b]
76-44-8	Heptachlor	0.1 [e]	0.1 [e]	23	1
1024-57-3	Heptachlor epoxide	0.07 [e]	5 [e]	0.7	0.03
118-74-1	Hexachlorobenzene	0.4 [e]	1 [e]	2	0.1 [f]
87-68-3	Hexachloro-1,3-butadiene	8 [e]	8 [e]	2	0.1 [f]
319-84-6	α-HCH (α-BHC)	0.1 [e]	0.8 [e]	0.0005 [e,f]	3E-05 [e,f]
319-85-7	β-HCH (β-BHC)	0.4 [e]	--- [g]	0.003 [e]	0.0001 [e,f]
58-89-9	γ-HCH (Lindane)	0.5 [e]	--- [c]	0.009	0.0005 [f]
77-47-4	Hexachlorocyclopentadiene	550 [b]	10 [b]	400	20
67-72-1	Hexachloroethane	46 [e]	55 [e]	0.5 [e]	0.02 [e,f]
193-39-5	Indeno(1,2,3-*cd*)pyrene	0.9 [e]	--- [c]	14 [e]	0.7 [e]
78-59-1	Isophorone	670 [e]	4,600 [d]	0.5 [e]	0.03 [e,f]
7439-97-6	Mercury	23 [b,l]	10 [b,i]	2 [i]	0.1 [i]
72-43-5	Methoxychlor	390 [b]	--- [c]	160	8
74-83-9	Methyl bromide	110 [b]	10 [b]	0.2 [b]	0.01 [b,f]
75-09-2	Methylene chloride	85 [e]	13 [e]	0.02 [e]	0.001 [e,f]
95-48-7	2-Methylphenol	3,900 [b]	--- [c]	15 [b]	0.8 [b]
91-20-3	Naphthalene	3,100 [b]	--- [c]	84 [b]	4 [b]
98-95-3	Nitrobenzene	39 [b]	92 [b]	0.1 [b,f]	0.007 [b,f]
86-30-6	*N*-Nitrosodiphenylamine	130 [e]	--- [c]	1 [e]	0.06 [e,f]
621-64-7	*N*-Nitrosodi-*n*-propylamine	0.09 [e,f]	--- [c]	5E-05 [e,f]	2E-06 [e,f]
1336-36-3	PCBs	1 [h]	--- [h]	--- [h]	--- [h]
87-86-5	Pentachlorophenol	3 [e,j]	--- [c]	0.03 [f,i]	0.001 [f,i]
108-95-2	Phenol	47,000 [b]	--- [c]	100 [b]	5 [b]
129-00-0	Pyrene	2,300 [b]	--- [c]	4,200 [b]	210 [b]
100-42-5	Styrene	16,000 [b]	1,500 [d]	4	0.2
79-34-5	1,1,2,2-Tetrachloroethane	3 [e]	0.6 [e]	0.003 [e,f]	0.0002 [e,f]

Table A-1 (continued)

Organics				Migration to ground water	
CAS No.	Compound	Ingestion (mg/kg)	Inhalation volatiles (mg/kg)	20 DAF (mg/kg)	1 DAF (mg/kg)
127-18-4	Tetrachloroethylene	12 [e]	11 [e]	0.06	0.003 [f]
108-88-3	Toluene	16,000 [b]	650 [d]	12	0.6
8001-35-2	Toxaphene	0.6 [e]	89 [e]	31	2
120-82-1	1,2,4-Trichlorobenzene	780 [b]	3,200 [d]	5	0.3 [f]
71-55-6	1,1,1-Trichloroethane	--- [c]	1,200 [d]	2	0.1
79-00-5	1,1,2-Trichloroethane	11 [e]	1 [e]	0.02	0.0009 [f]
79-01-6	Trichloroethylene	58 [e]	5 [e]	0.06	0.003 [f]
95-95-4	2,4,5-Trichlorophenol	7,800 [b]	--- [c]	270 [b,i]	14 [b,i]
88-06-2	2,4,6-Trichlorophenol	58 [e]	200 [e]	0.2 [e,f,i]	0.008 [e,f,i]
108-05-4	Vinyl acetate	78,000 [b]	1,000 [b]	170 [b]	8 [b]
75-01-4	Vinyl chloride	0.3 [e]	0.03 [e]	0.01 [f]	0.0007 [f]
108-38-3	*m*-Xylene	1.6E+05 [b]	420 [d]	210	10
95-47-6	*o*-Xylene	1.6E+05 [b]	410 [d]	190	9
106-42-3	*p*-Xylene	1.6E+05 [b]	460 [d]	200	10

Table A-1 (continued)

Inorganics				Migration to ground water	
CAS No.	Compound	Ingestion (mg/kg)	Inhalation fugitive particulate (mg/kg)	20 DAF (mg/kg)	1 DAF (mg/kg)
7440-36-0	Antimony	31 [b]	--- [c]	5	0.3
7440-38-2	Arsenic	0.4 [e]	750 [e]	29 [i]	1 [i]
7440-39-3	Barium	5,500 [b]	6.9E+05 [b]	1,600 [i]	82 [i]
7440-41-7	Beryllium	0.1 [e]	1,300 [e]	63 [i]	3 [i]
7440-43-9	Cadmium	78 [b,m]	1,800 [e]	8 [i]	0.4 [i]
7440-47-3	Chromium (total)	390 [b]	270 [e]	38 [i]	2 [i]
16065-83-1	Chromium (III)	78,000 [b]	--- [c]	--- [g]	--- [g]
18540-29-9	Chromium (VI)	390 [b]	270 [e]	38 [i]	2 [i]
57-12-5	Cyanide (amenable)	1,600 [b]	--- [c]	40	2
7439-92-1	Lead	400 [k]	--- [k]	--- [k]	--- [k]
7440-02-0	Nickel	1,600 [b]	13,000 [e]	130 [i]	7 [i]
7782-49-2	Selenium	390 [b]	--- [c]	5 [i]	0.3 [i]
7440-22-4	Silver	390 [b]	--- [c]	34 [b,i]	2 [b,i]
7440-28-0	Thallium	--- [c]	--- [c]	0.7 [i]	0.04 [i]
7440-62-2	Vanadium	550 [b]	--- [c]	6,000 [b]	300 [b]
7440-66-6	Zinc	23,000 [b]	--- [c]	12,000 [b,i]	620 [b,i]

DAF = Dilution and attenuation factor.

[a] Screening levels based on human health criteria only.

[b] Calculated values correspond to a noncancer hazard quotient of 1.

[c] No toxicity criteria available for that route of exposure.

[d] Soil saturation concentration (C_{sat}).

[e] Calculated values correspond to a cancer risk level of 1 in 1,000,000.

[f] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).

[g] Chemical-specific properties are such that this pathway is not of concern at any soil contaminant concentration.

[h] A preliminary remediation goal of 1 mg/kg has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (U.S. EPA, 1990) and on EPA efforts to manage PCB contamination.

[i] SSL for pH of 6.8.

[j] Ingestion SSL adjusted by a factor of 0.5 to account for dermal exposure.

[k] A screening level of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (U.S. EPA, 1994).

[l] SSL is based on RfD for mercuric chloride (CAS No. 007487-94-7).

[m] SSL is based on dietary RfD.